Blue Leash

Go carefree, no more losing!

Advanced Product Design Method, Team No. 8

ACKNOWLEDGEMENT

We would like to thank our guide, Dr. Yi Max Ren for his valuable help and encouragement without whom this project would not have been possible. We are very much thankful to him for his expertise knowledge and guidance throughout our study, which has provided us a valuable insight in number of areas. We thank all are teammates for their efforts in completing the project. Lastly, we, the team members, would like to thank Arizona State University for the opportunity to work with the facilities.

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1. INTRODUCTION

1.1 THE PROBLEM STATEMENT

Passports, wallets and key chains are vulnerable to getting lost, stolen or misplaced while in crowded places such as markets, tourist places or parties, etc. With a limitless selection of tracking devices out there to help you trace your lost belongings, we believe that there is a superior way - to prevent loss in the first place.

1.2 EXISTING PRODUCTS IN THE MARKET

Few products of similar functions are currently available in the market such as Tile tracker, PebbleBee, TrackR bravo and MYNT tracker. The technology incorporated in these devices is Bluetooth Low Energy (BLE) which facilitate low energy consumption and low cost at similar connectivity range compared to the classic Bluetooth.

The products available in the market mainly focus on finding the misplaced or lost belongings, but what we are trying to achieve is to avoid misplacing in the first place.

1.3 DESIGN GAP

Several products in the market today address the problem that we are tackling, but all existing solutions are useful after the valuable (Passport, wallet, phone) has been lost. In our product, one can recognize and detect the loss of an item instantly and notify the user to act.

The major drawbacks of existing products include:

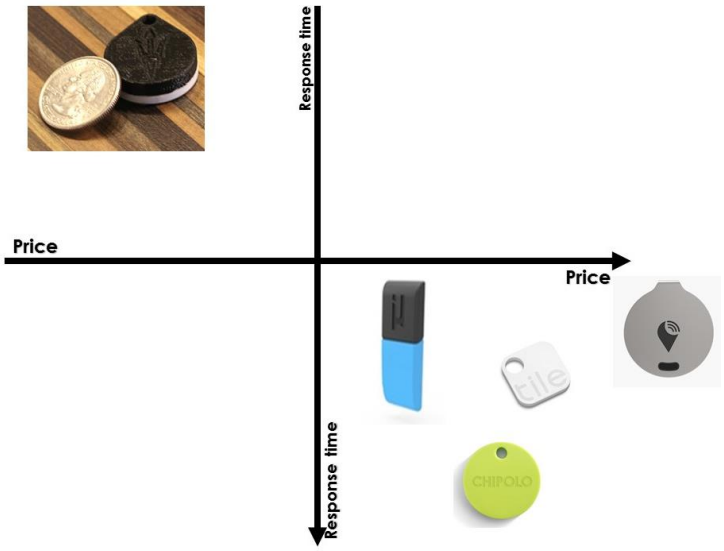
1. Cannot work without mobile phone/laptop applications - Depends on Bluetooth connectivity with mobile phones to help track and locate device.

2. These products are useful only after your wallet/passport is lost; which in many cases is too late!

3. Can be disabled/removed by the thief, hence rendering it useless - Our product aims to be inconspicuous and unidentifiable by the thief.

4. Cannot be used in different valuable items - E.g., Tile tracker or the TrackR cannot be attached to a passport.

Our product aims to fill this 'market gap' by its small size and provide a solution that is practical and hassle free.



2. POTENTIAL MARKET

- Tourists, Frequent travellers - Travellers tend to sleep at airports during long layovers
- Students - You might leave behind your wallet, keys at the coffee shop
- People residing in crowded cities - Pick-pocketers could be lurking anywhere
- Party – goers - Things may slip out of your pockets unknowingly

2.1 MARKET ANALYSIS

2.1.1 SURVEY GOAL

A survey was conducted to gather data about the marketability of the product, recognize the potential customer demographics and to understand the customer behaviour patterns to optimize the product utility. Specifically, do people care about the problem and how much would the customer be willing to spend on the product, identification of the of the things

that people carry with them in everyday life and which of those belongings are vulnerable to this issue.

2.1.2 ATTRIBUTES

Five attributes have been considered for the development of the product. The following are the attributes and their levels:

- Price: The price of the product is a crucial design attribute that influence the market share of the product. The three attribute levels considered are from $15 - $20, $20 - $30 and $30 - $50.

- Mode of Alert: This design attribute concerns with the method of notifying the user when the belonging(s) is misplaced or stolen. The different attribute levels considered are ‘Vibration only’, ‘Sound Alert only' and 'Both Vibration & Sound’.

- Number of valuables the device can take care of: This is a design attribute which depends on the functionality of the product. This attribute is important in designing the sensors, optimizing the product size and battery life. The attribute levels are ‘1’,’2’ and ‘Multiple’.

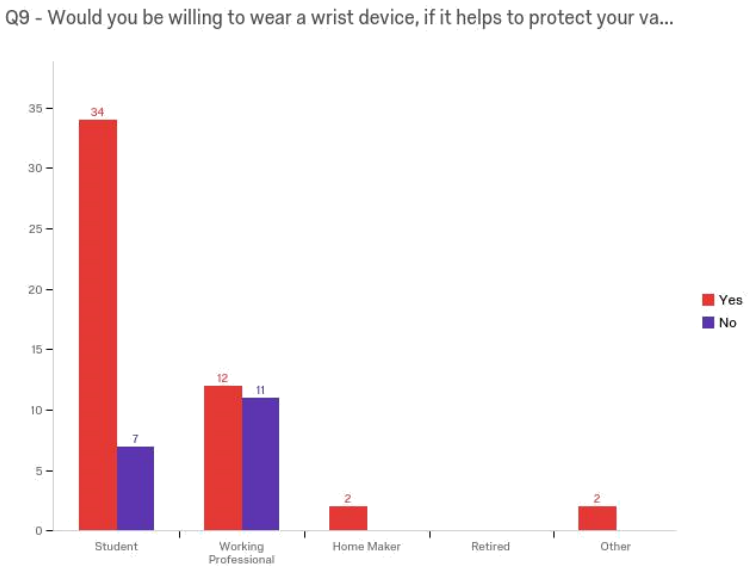
- Installation time: This design attribute regards to the user experience. This depends on the time taken to install the device. The attribute levels are 'Buy and use (0min)','5mins' and '10mins'.

- Device setup: The user friendliness of the product depends on this design attribute. This attribute would drive the use of different technology employed the device. The attribute levels are based on the number of devices present in the system architecture. The attribute levels are 'Wrist device only' and 'Wrist device + Secondary device in pocket’.

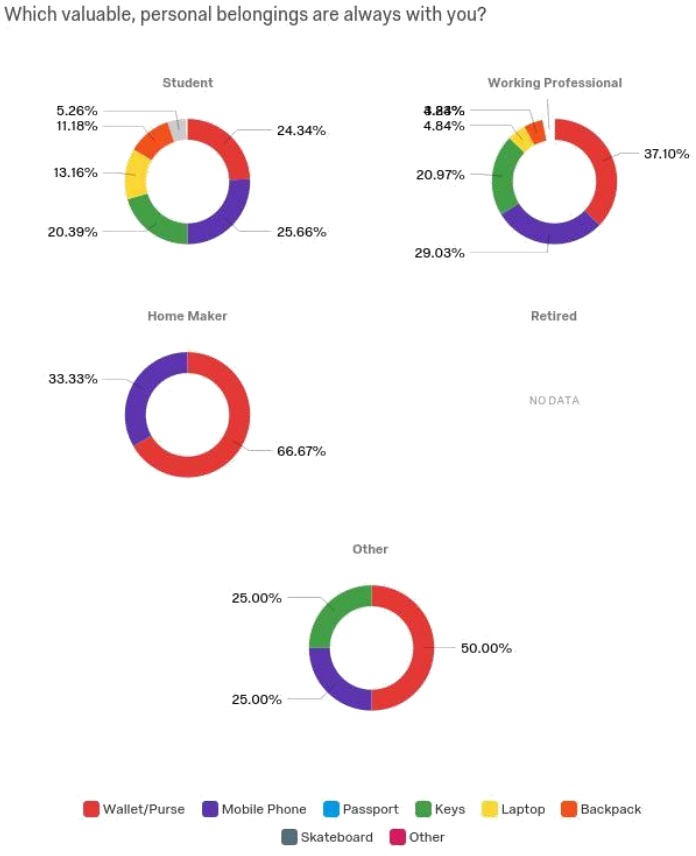
2.1.3 DATA COLLECTION

The online survey was created using Qualtrics survey tool. The URL of the survey generated by Qualtrics was shared among the students of the APDM course and among friends and family. The first draft of the survey was generated on Feb 12 and the final draft of the survey was generated on Feb 18. The final survey was conducted on Feb 18, 2017. 67 people completed the survey and an attempt was made to include people from different age groups and different countries in the survey.

The sample set mostly consisted people in the United States and India. However, a few entries from the United Arab Emirates and Switzerland have also been obtained. More than 80 percent of the sample set belonged to the age group 18-25.



Majority of the students don't mind wearing a wrist device if it would help them keep track of their belongings. The working professionals in the sample set are almost equally divided on the 2 choices. The other categories are positive about wearing a wrist device.

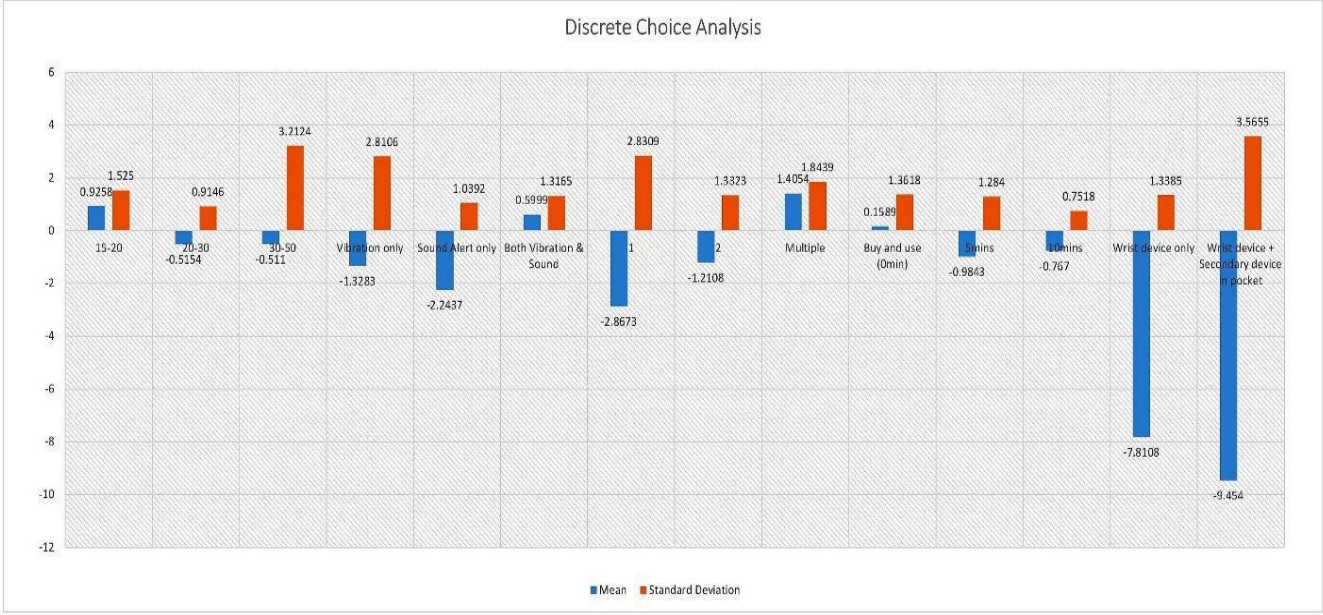


Wallets and mobile phones are the personal belongings that all the people in the sample set carry with them, irrespective of their profession. Keys come next in their priority list. It can be therefore inferred that a device which could keep track of keys, mobile phones and wallets would do well in the market.

2.1.4 DISCRETE CHOICE ANALYSIS

Discrete Choice Analysis Results

Attributes	*Price Range*			*Mode of Alert*			*No. of Valuables it can Handle*			*Installation Time*			*Device Setup*	
Levels	15-20	20-30	30-50	Vibration only	Sound Alert only	Both Vibration & Sound	1	2	Multiple	Buy and use (0min)	5mins	10mins	Wrist device only	Wrist device + Secondary device in pocket
Mean	0.9258	-0.5154	-0.511	-1.3283	-2.2437	0.5999	-2.8673	-1.2108	1.4054	0.1589	-0.9843	-0.767	-7.8108	-9.454
Standard Deviation	1.525	0.9146	3.2124	2.8106	1.0392	1.3165	2.8309	1.3323	1.8439	1.3618	1.284	0.7518	1.3385	3.5655



Discrete choice analysis in the online market survey gave an insight to the customer preferences of the various design attributes of the product. In the case of price range, customers preferred the product to be priced between 15-20. Since the mean value of the price ranges 20-30 and 30-50 are almost the same and negative, it could be inferred that customers would like the product to be priced below 20$.

The data on the mode of alert reveals that the sample set wanted both vibration and sound as the mode of alert on the device. It had a mean value of 0.9999. Even though the mean value of both 'sound only' (2.2437) and 'vibration only' (-1.3283) are in the negative range, people preferred just vibration on the product much more than how much they liked the idea of having sound only as the mode of alert.

The sample set wanted the device to handle at least 2 personal belongings and preferred the device to be able to handle multiple devices. ‘Buy and Use’ option was most favoured in the attribute ‘Installation Time’. Since the value of mean of both the options in Device Setup returns high negative values, the data loses some credibility. However, people are found to dislike the idea of having a pocket device in addition to a wrist device.

3. CONCEPT GENERATION & SELECTION

The initial concept consisted of an RFID receiver and an RFID tag on the wrist-device and wallet respectively, that would communicate with each other and provide an alert on the wrist-device whenever the latter went out of range. However, the idea of using RFIDs in our product had to be discarded because of the bulky size of active RFID transceivers and low range of passive RFIDs.

The other options in hand were to use NFC, luxometer, magnetometer, proximity sensors or BLE (Bluetooth Low Energy) sensors. Even though the response-time of NFC tags were low, it has very low range and requires an additional device in the pocket to communicate with the wrist device. Furthermore, it was hard to prevent it from giving false alarms whenever you take your wallet or phone out of your pocket on purpose. Similar issues were faced when using magnetometer.

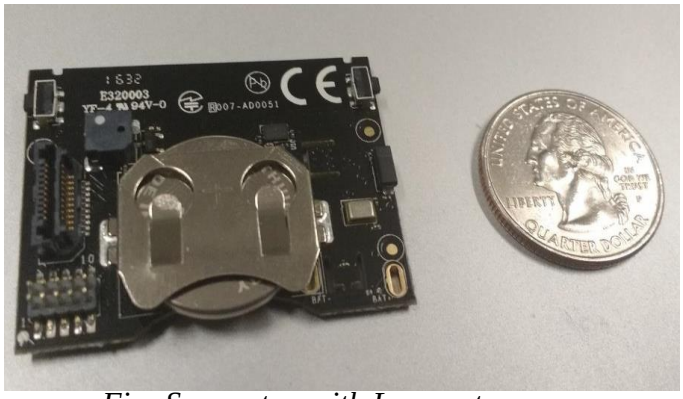


Fig: Sensor tag with Luxometer

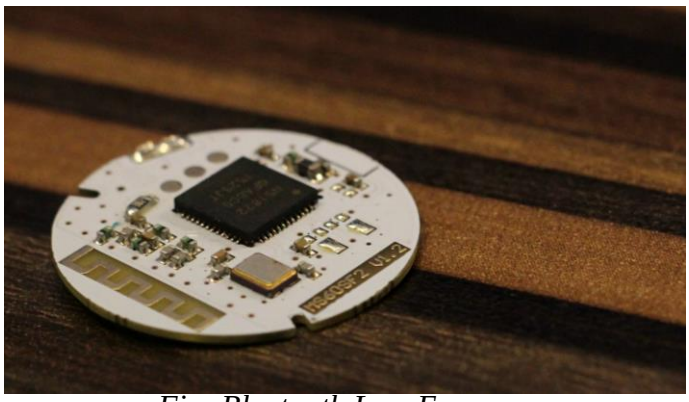


Fig: Bluetooth Low Energy

A different concept was considered where luxometers would be used to alert the user when the light intensity around the wallet/phone changes drastically in a short time-interval. The loophole in the concept was that luxometers lose feasibility in dark environments and would never alert the user if his immediate surroundings had very low light intensity. If proximity sensors were added to the concept to introduce multiple redundancies, apart from complicating the device and making it hard to attach to the personal belonging, it is not hard to imagine a scenario where both sensors could fail.

The current concept employs a BLE (Bluetooth Low Energy) transmitter that would be attached to the personal belonging and a wearable wrist device having a BLE receiver. When the transmitter goes beyond a particular range, the drop-in signal strength that is received at the receiving end is the triggering mechanism. This will trigger vibrations in the wrist device that would alert the user.

An android app that can be used on any android smartwatch in combination with the BLE transmitter is also under consideration and would probably be included in the final product.

4. PRODUCT DESCRIPTION

"An effective solution to prevent either the theft of personal belongings or their loss due to misplacement during travel or in crowded places." This solution aims to solve these problems using a practical, affordable and user friendly system.

The Blue Leash is a tiny tag that helps you put your belongings on an electronic leash connected to your mobile phone or smartwatch. The user gets notifications on his phone whenever the tag goes beyond hand's reach. It can be attached to any personal belonging like a mobile phone, wallet, backpack etc.

4.1 APPLICATIONS OF THE PRODUCT

The product can be attached to many different personal belongings. It is designed to have a nano-hold surface on one side which can attach to most surfaces such as passports, mobiles and bags. The key hook can be used to attach to a key chain or a purse. The varied uses of this product and its small size is the key selling feature.


GENUINE LEATHER
MADE IN EGYPT
Devotté


PASSPORT
REPUBLIC OF INDIA

4.2 COMPONENTS

4.3 WORKING PRINCIPLE – BLUETOOTH BEACON

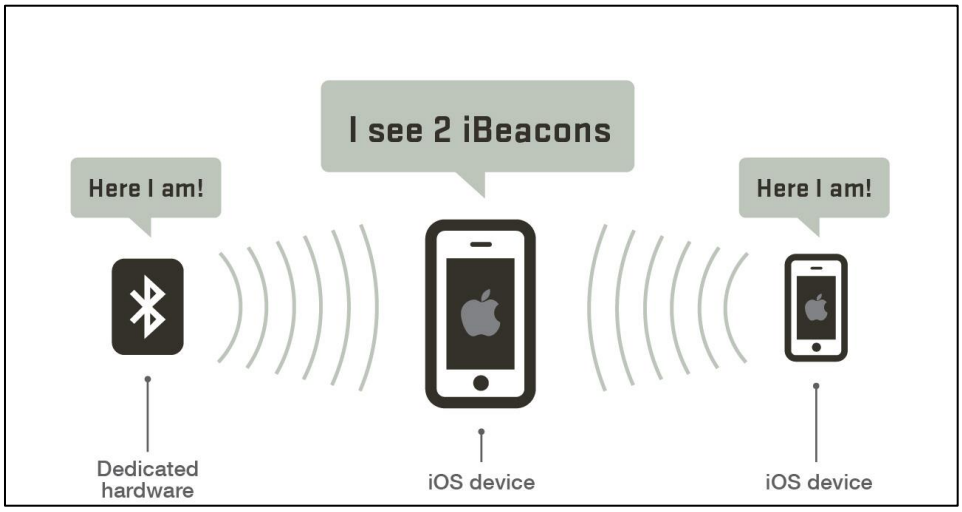
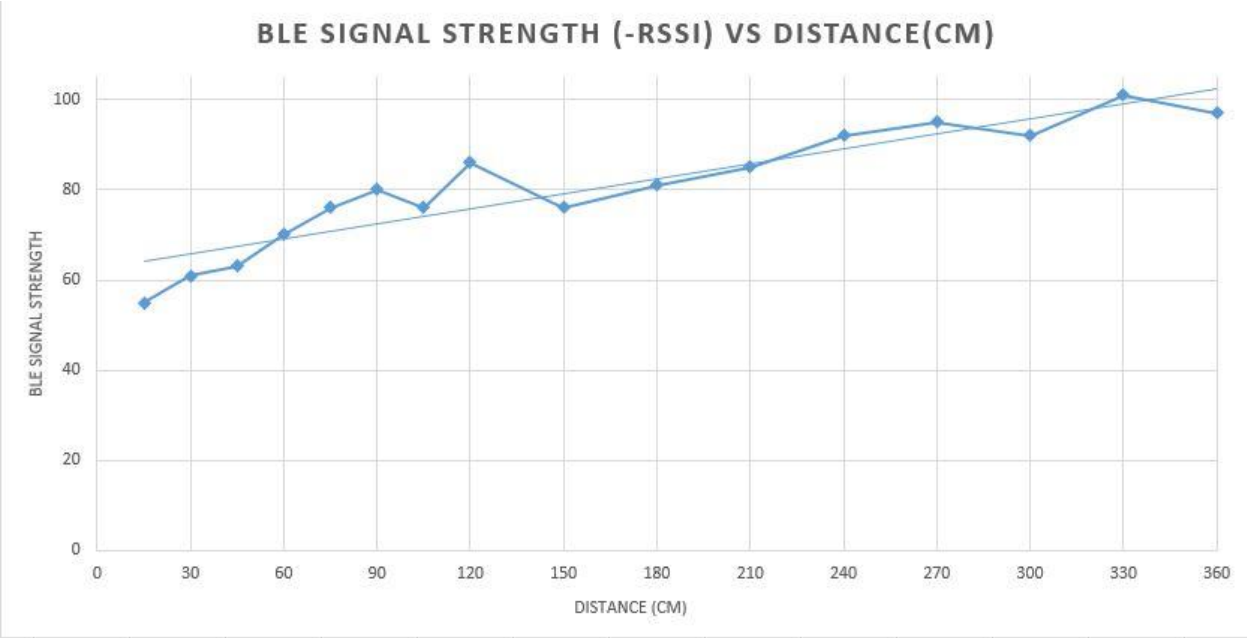


Image courtesy: ibeacon.com

Beacon technology is a protocol first introduced by apple in 2013 as ibeacon. Since then many other organization have developed their platforms such as Google's eddystone, Opensource altbeacon etc. Beacons are low energy Bluetooth devices that advertise their existence to nearby electronic devices. This is based on Bluetooth low energy proximity sensing using a universally unique identifier(UUID). The beacons permanently broadcast their UUID on a regular interval. Beacon advertisement is a one-way communication method. BLE enabled smartphones or other devices in the region can know that the beacon is in a proximity. A compatible app can trigger an action on the smartphone e.g.: displaying a push message on the screen when the beacon is at distance.

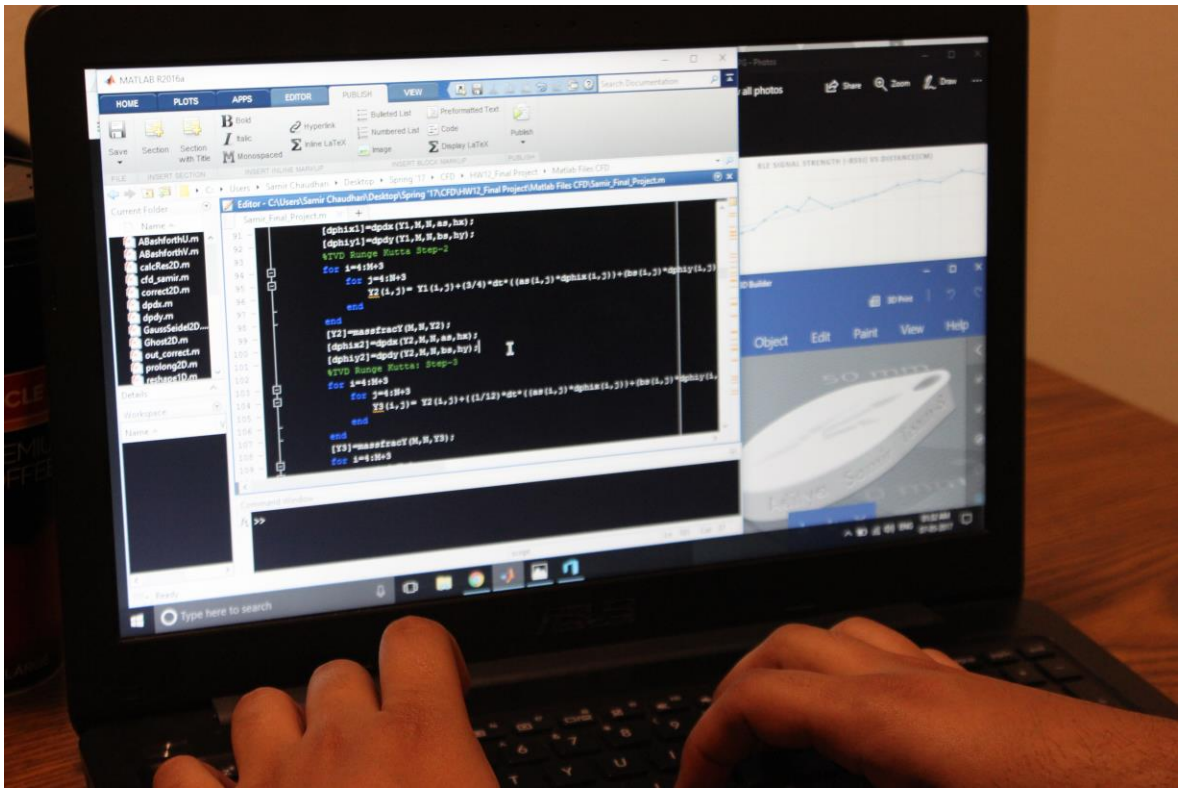


Different beacon platforms have their advertising format. In ibeacon, the advertised data has four information pieces:

- UUID- This is a 16 byte string to differentiate a large group related beacons. For example, usually a company or an organization would use a UUID.
- Major- this is a 2 byte string used to smaller subset of beacons within the larger group. ie, the company would use the same major for all their beacons in a specific branch or at a specific store of a chain.
- Minor-this is a 2 byte string used to identify each individual beacons. It means each beacon of a company in a specific store can be identified.
- Tx Power- It is used to determine proximity from the beacon. It is defined as the signal strength when the beacon is exactly 1 meter away. This has to be calibrated and hardcoded. This is used by the devices to get an approximate distance to the beacon.

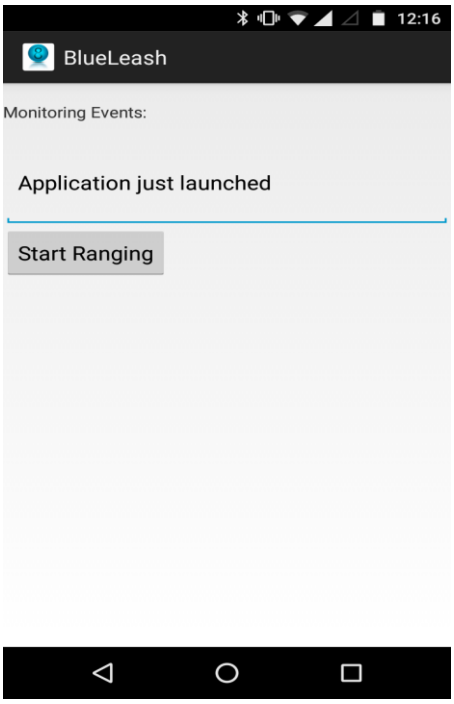
4.4 ANDROID APPLICATION

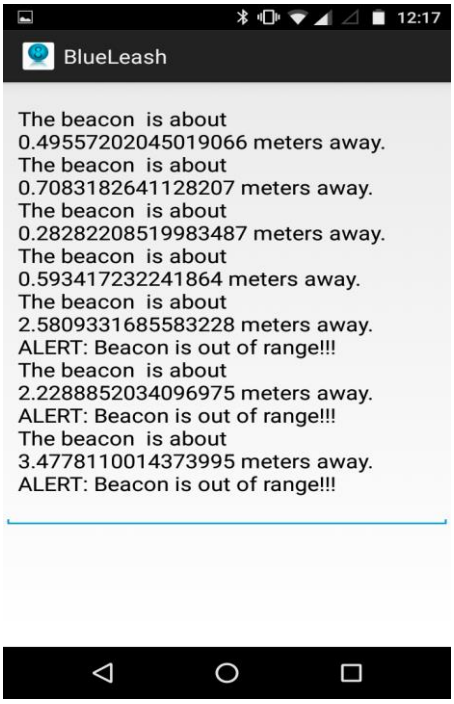
An android application has been developed using Android Studio. The current application can run on android smartphones with Marsh mellow or a later version of android. The app was developed using an open source beacon library provided by Radius Networks. The min SDK version of the android is API 19 and the target SDK is API 23. The app has two activities: Monitoring Activity and Ranging Activity.



Once the app is launched the monitoring activity would begin, this activity can run in the background as well. The monitoring activity scans for the beacons that are in the range. If the

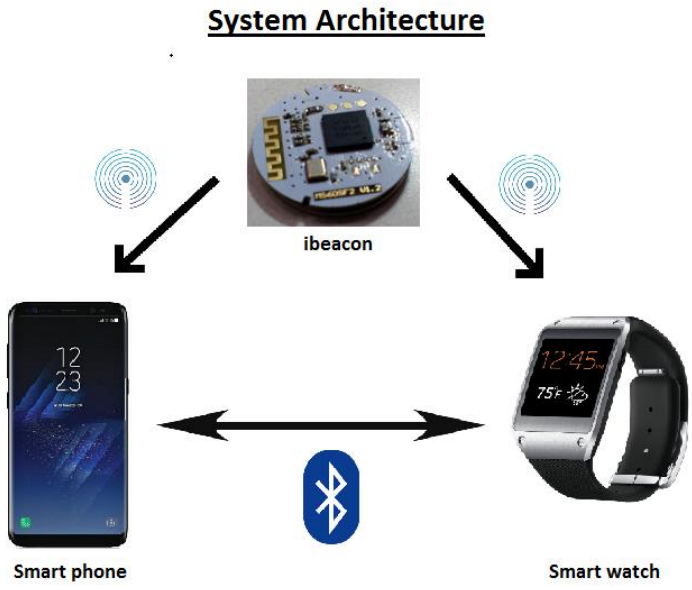
phone detects any beacons, it would notify the user that a new beacon is nearby. When the beacon leaves the Bluetooth range, it will notify the user that the beacons has left the region.





The ranging activity is a foreground service, which is used to range in the beacons in the region. This activity will give an approximate distance to your beacons. You can set a perimeter for your beacons. So that if the beacon goes out of the set perimeter, the user will get vibration and a sound notification that the beacon is out of range. The notification wouldn't go off until the beacon is back inside the set perimeter.

4.5 SYSTEM ARCHITECTURE

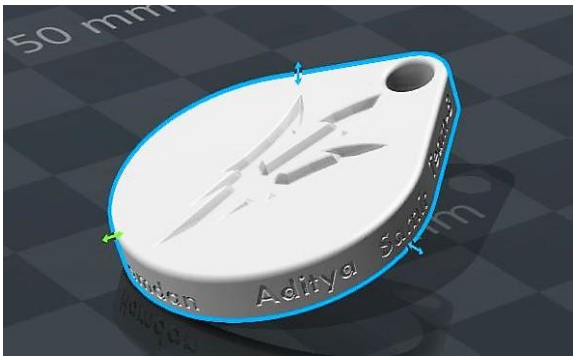


The solution system consists of an ibeacon, smartphone and a smart watch. Either a smart watch or a smart phone is only required to achieve the basic functionality. But having an extra device could improve the functionality and accuracy greatly.

The beacon continuously advertises its existence to the smartphone and the smartwatch. So, with the compatible app running on the device, the beacon could be detected. By measuring the received signal strength(RSSI) of the broadcasted data from the beacon, an approximate distance of can be calculated. This system is more prone to false alarms because the instability of the signal strength.

By bringing an extra Bluetooth device into the network, the accuracy of the system can be improved to avoid false alarms. In the two-device architecture, two smart devices communicate with each other over Bluetooth network. The signal strength received by each device are communicated to other device, so the system will only notify the user when both device detect a significant fall in the measured Bluetooth signal strength(RSSI). Better accuracy could be achieved using this architecture.

4.5 3-D PRINTED HOUSING DESIGN



A 3-D printed casing was designed to fulfil basic functionalities and house the Bluetooth beacon microprocessor module

- The casing needs to be compact and lightweight
- It should be able to sustain crushing loads and should not break
- The product should be aesthetic and ergonomic
- Should have attachments for wallet, keys, passport, etc.

A Nano-hold surface is provided at the back of this tag, this surface would enable the tag to be attached to various surfaces and can be reused several times.

5. BUSINESS PLAN

5.1 BUSINESS OBJECTIVE

The primary business objective is to capture a major share in the market of loss-prevention devices which is still in its early stage. Currently, the market has only a handful of products in the same segment, which are sold at 25-30 apiece. Our objective is to provide an alternative solution which is both cheap in price and more efficient in performing the intended task.

With further research and development, the product could be extended to other applications like intelligent package tracking (logistics), tracking user footprints to business analytics etc.

5.2 FINANCIAL DATA

Initial Development		**Fixed Operating Cost (for 1 year)**	
		Employees	
Engineering	$3,750	Marketing & Sales	$37,000
Industrial Design	$3,750	Cleaning & Maintenance	$1,400
Marketing	$10,000	Salary for Employees	$115,200
Developement		R & D	$76,800
		Administratives	
Equipment	$40,000	Rent	$20,000
Set-up	$1,000	Utilities	$8,000
		Insurance	$15,000
Sum	$58,500	Sum per Year	$273,400

Table: Development Costs

There are two basic costs which are categorized briefly in our development of business plan

- Fixed Cost
- Fixed Operating Cost

Fixed costs act only once as it's just one time investment during the development of the product. Expenses incurred for equipment purchase and setup, employing personnel for various tasks and outsourcing the manufacture of components have been included in this segment. The fixed operating costs comprises of 2 sub-categories - salaries for the employees and administrative costs. Initially we plan to employ 4 people for assembly, programming and testing work at a remuneration of $15/hr and 2 people for R&D at $20/hr. Employee's salaries also include the budget we set for marketing strategies through which we planned to reach as many people as possible.

The fixed administrative costs include the rent for the office and assembly space, utilities, insurance and other overhead costs that impact our production and development every year. The entire calculation of the fixed costs has been done based on the basis of costs at Austin, Texas where the labour cost, rents and the business environment is apt for our product.

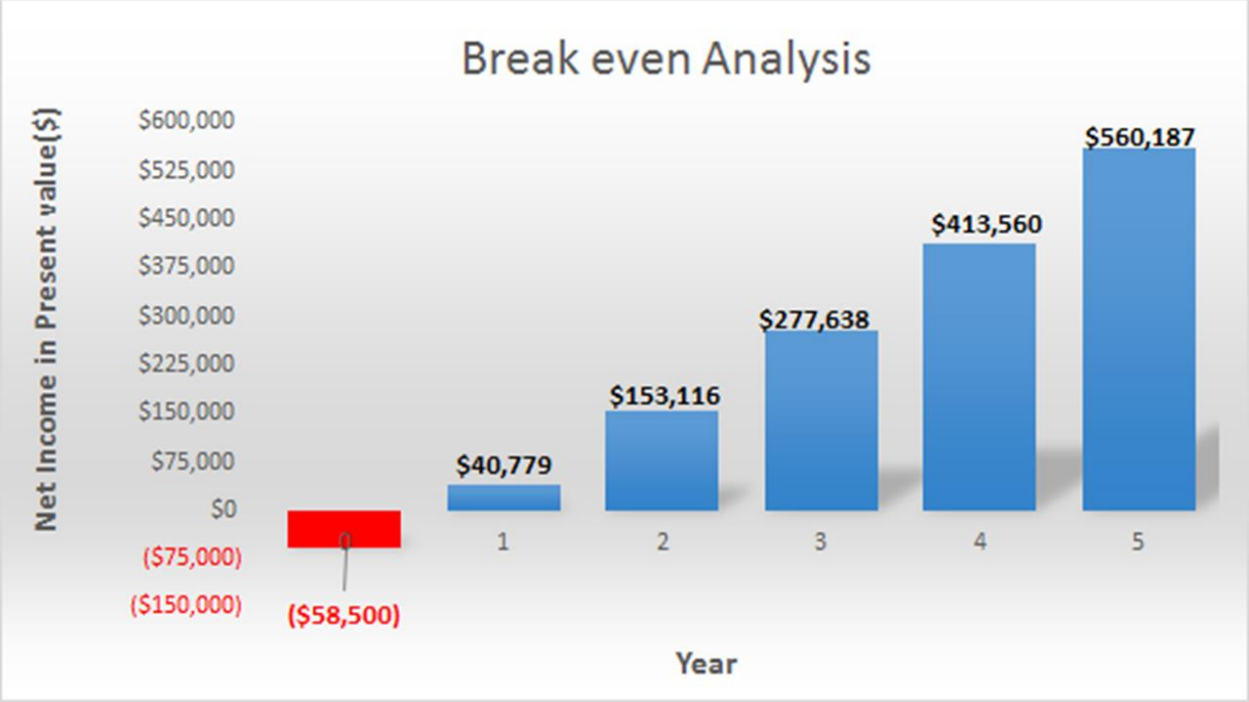
5.3 PROFORMA INCOME STATEMENT & COST PROJECTIONS

Proforma Income Statement						
Price	25					
Cost per unit	10					
Starting sales	30000					
Sales growth rate	10%					
Tax rate	39%					
Discount rate	6%					
Project year	**0**	**1**	**2**	**3**	**4**	**5**
Income						
Investor contribution	100000					
Total sales	0	30000	33000	36300	39930	43923
Sales revenue	0	750000	825000	907500	998250	1098075
Expense						
Initial cost	58500					
Cost of product	0	300000	330000	363000	399300	439230
Fixed operating cost	0	273400	273400	273400	273400	273400
Net profit	41500	176600	221600	271100	325550	385445
Post-tax profit	41500	107726	135176	165371	198585.5	235121.45
Running cash balance	41500	149226	284402	449773	648358.5	883479.95
Present value conversion	41500	140779.2453	253116.7675	377638.0838	513560.6594	660187.6132
Breakeven	**-58500**	**40779.24528**	**153116.7675**	**277638.0838**	**413560.6594**	**560187.6132**

5.4 LIST OF ASSUMPTIONS

- A sale of 30,000 units in the first year, which is less than 1% of the target market.
- Sales growth-rate of 10% which is comparable to the other competitors in the market.
- Same number of employees as the first year for 5 years, at the same salary.
- Accounting for a 25% distributor markup.
- Salaries for the employees have been calculated by setting the minimum wages in the state(7.25$/hr) as the benchmark.

5.5 BREAKEVEN ANALYSIS



During the zeroth year, there will not be any sales and thereby, we will get a negative cash flow during that year. However, as blue leash hit the shelves during the first year,

The market revenue combined with very low production costs let us attain a positive cash flow at the end of the year. By the end of the 5th year, our profit is expected to reach well beyond half a million dollars.

6. EXISTING PATENTS

6.1 US 9357348 B2 (Published on: May 31,2016):

ABSTRACT

The principles described herein provide methods and systems for locating a tracking device. One disclosed method includes associating a user with a tracking device, receiving an indication that the tracking device is lost, setting a flag indicating that the tracking device is lost, receiving a location within a proximity of the tracking device from one of a plurality of mobile devices associated with a community of users, and providing the location to the user.

This is a patent for tile tracker. The tile tracker uses BLE to locate a lost item based on data received within the community of tile users if they are near the chip. However, in Blueleash, the user is alerted as soon as the item goes out of range. Moreover, a number of belongings can be associated with Blueleash rather than a single item.

6.2 US 20100283600 A1 (Published on: Jan 25,2010):

ABSTRACT

A system for the prevention of loss of wallets, keys, purses and the like. The system uses a programmable wireless appliance such as a cell phone as a wireless tracker, and utilizes lightweight wireless tag devices attached to the items to protected. A software application executes on the wireless appliance to query the wireless tags and determines when any part of the system is going out of range.

This is a patent for chipolo tracker. Chipolo is a passive system and alerts the user when he wants it to - that is, when he realises he has misplaced any of his personal belongings connected with chipolo.

Blueleash is an active tracker that remains connected to the user's mobile phone or smartwatch all the time (unless disabled by the user), and continuously monitors the proximity of the belongings with the user. Since it instantaneously gives an alert to the user whenever the tag goes out of range, there is no question of a second person removing the tag from the product and stealing it.

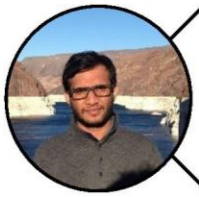
7. FUTURE SCOPE

- Developing a ‘crowd-GPS’ functionality to look for lost beacons.
- Incentivizing the finder
- Tracking user footprint – Selling to businesses for analytics’
- Assistance for the visually impaired – In banks, shops, offices etc.
- Bike theft
- Package delivery logistics.
- Library – Book issue, or to find a book

OUR TEAM

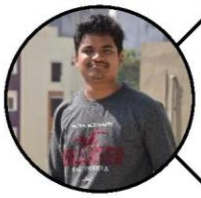
Dr. Yi Max Ren, Assistant Professor, Mechanical and Aerosapce Engineering, Arizona State University

Arjun Venugopal, Mechanical Engineer, Arizona State University



Hamdan Peringattuthodi, Mechanical Engineer, Arizona State University

Samir Chaudhari, Aerospace Engineer, Arizona State University



Aditya Vara Prasad Naidu BVSR, Aerospace Engineer, Arizona State University

Priyank Vekaria, Mechanical Engineer Arizona State University